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INSTRUCTION MANUAL

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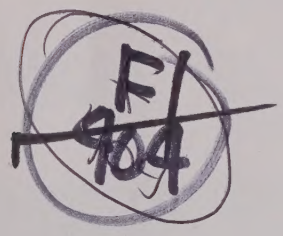
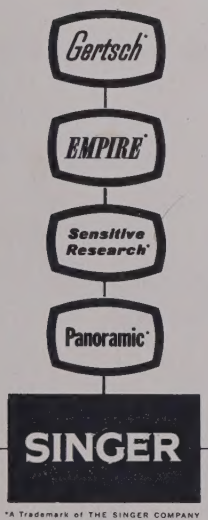
*Sensitive Research**

POCKETPOT

MODELS PC AND PCM





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Precision electrical and electronic instruments for measurement

THE SINGER COMPANY • METRICS DIVISION

To the user of SINGER Instrumentation:

SINGER instruments are fabricated and tested under conditions of rigid manufacturing and quality control according to the best practice of the current state of the art. In addition, our Service and Applications Sections are available to you at any time.

The registration of your instruments and any comments will be most appreciated. The information concerning fields of application will aid us in providing you with pertinent literature from time to time.

REGISTRATION CARD

THE SINGER COMPANY
METRICS DIVISION

Name.....

Address.....

Models:..... Serial No. .....

....

Date..... CONDITION ON ARRIVAL.....

FIELDS OF APPLICATION: .....

SEND APPLICATION DATA TO: .....

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COMMENTS: .....

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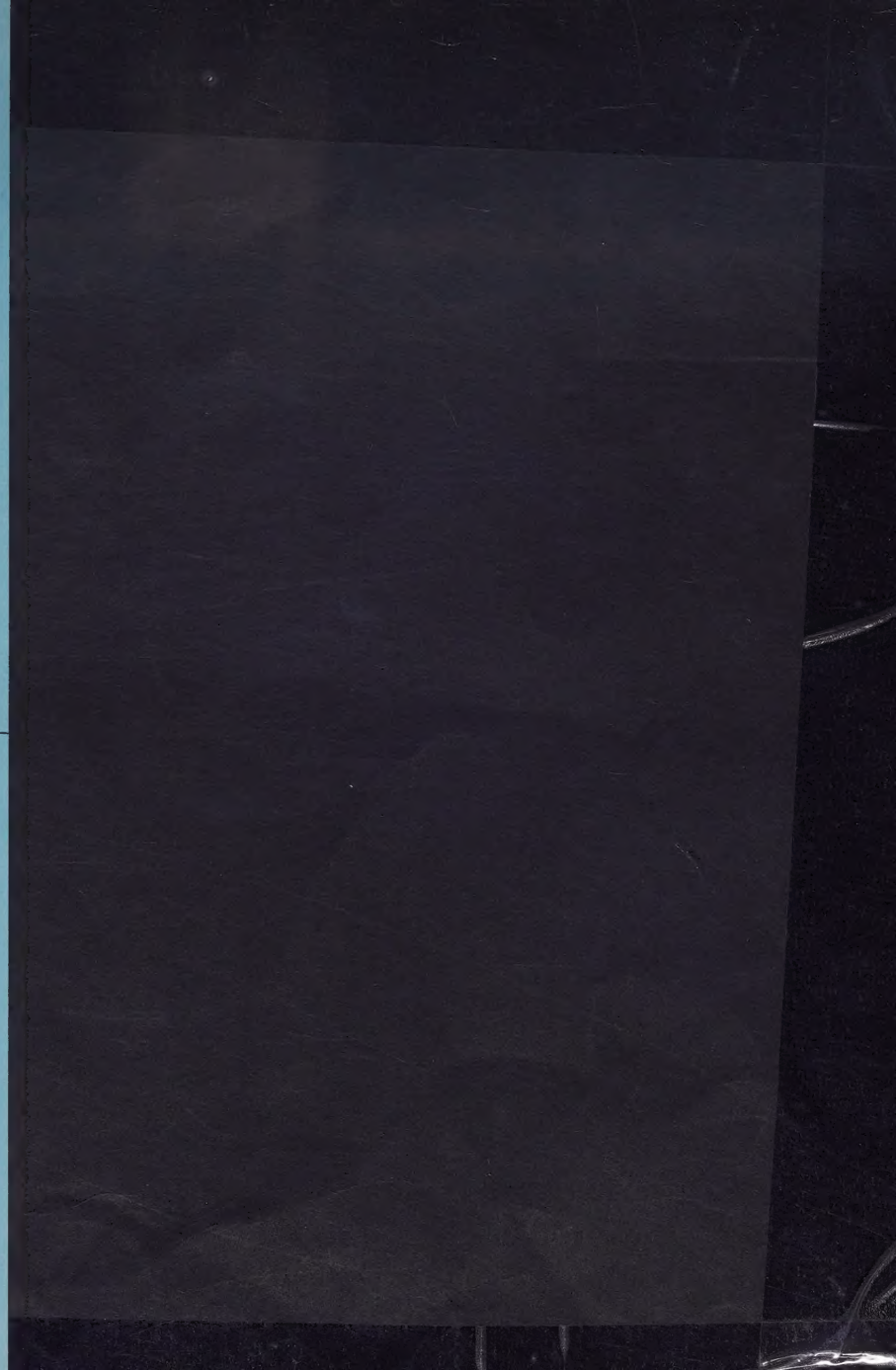
Name & Title



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THE SINGER COMPANY
METRICS DIVISION
915 Pembroke Street
Bridgeport 8, Conn.

DESCRIPTION

As the name implies the Models PC and PCM are miniature potentiometers. These Models have a self contained battery source, an internal reference and built-in high sensitivity detector. The single pocket sized unit is all that is required for potentiometric measurements replacing the usual potentiometer (with markedly higher than usual voltage ranges) and also it's battery, the standard cell and the galvanometer. It is ideal for field use and can easily be hand held and operated. The internal batteries will have approximately 75 hours of continuous operation and several times this many hours of intermittent operation.

SPECIFICATION

	PC	PCM
Range	0 to 5.100	X1 = 0 to 5.100 X.1 = 0 to 0.510 X.01 = 0 to 0.051
Accuracy	±0.05% or ± 0.5 mv which ever is larger	X1 = ± 0.05% or 0.5 mv X.1 = ± 0.05% or 0.1 mv X0.01 ± 0.1 mv
Resolution	1 mv/div	X1 = 1 mv/div X.1 = 0.1 mv/div X0.01 = 0.01 mv/div
Operating Power Requirements	2 - 1.4V Batteries 1 - 22.5V Battery	2 - 1.4V Batteries 1 - 22.5V Battery
Voltage Standard	0.01% Zener diode source	0.01% Zener diode source

PRINCIPLES OF OPERATION

A unique circuit is used to supply both the potentiometer operating current and also the required reference voltage. The current supplied from a self-contained battery is fed into a zero temperature coefficient zener reference diode. This input current is monitored by the instrument on the panel to an accuracy of 1%. The diode regulation curve is so steep at the point of operation that this 1% is sufficient to determine the zener voltage to within 0.01%. This zener voltage is both the source of the operating current and the reference for the potentiometer. The potentiometer is composed of a group of 50 matched resistors selected by a fifty position switch for 0.1 volt values from 0 to 5.0 volts. A separate slide wire with calibrated dial gives 0 to 100 millivolts for extrapolation between the 0.1 volt steps of the main dial. The Model PCM incorporates a range switch as an additional feature which decreases full scale indication in steps of 0.1 thereby increasing the resolution of the read-out dial.

The meter, which is used to monitor the diode input current, is also switched into the output of a transistor amplifier to serve as a sensitive detector for comparison of the potentiometer voltage with the external voltage under measurement.

OPERATION

Initial Operation: This requires the following steps to be followed:

1. Set the main drum dial, located on the side of the instrument, to the zero position.

2. Adjust the 0 - 100 millivolt dial to the zero position.

3. Short the input terminals with the leads supplied in the carrying case or with any standard banana plug leads.

4. Set the READ-CHECK CURRENT to the READ position.

5. Adjust the mechanical zero of panel meter by means of the slotted screw on the front of the instrument case until the pointer is directly over the zero indication.

6. Set the ON-OFF switch to the ON position.

7. If the instrument pointer is not at zero position bring it to the zero position by turning the small adjustment screw on the right side of the instrument marked ZERO ADJUSTMENT - SHORT CIRCUIT until a zero indication is obtained.

8. Remove the short from the input terminals.

9. If the instrument does not read zero bring the pointer to the zero position by means of the ZERO ADJUSTMENT - OPEN CIRCUIT adjustment screw.

NOTE

The above initial adjustments are required to correct for the normal battery deterioration. They are also required when instrument is changed from one ambient temperature to another. For full accuracy it is necessary that the instrument be at ambient temperature before using.

It is suggested that zero adjustments be made to within a pointer width of the exact Zero position, although the sensitivity of the detector is such that even though this is not done exactly only small errors will result. For Quick rough checks it is not necessary to make the zero adjustments at all, but to merely note the zero position and use that position as a temporary zero marker.

MEASUREMENTS

10. Connect the voltage to be measured to the INPUT terminals by means of banana plug leads. Observe correct polarity.

11. Set the READ - CHECK CURRENT switch to the CHECK CURRENT position and adjust the CURRENT CONTROL knob until the meter pointer is at the CHECK line at full scale. Wait 30 seconds and repeat the operation for possible drift, especially if operating in a low ambient temperature.

12. Set the range switch, on the Model PCM, to the multiple of 5.1 volts which will include the value of voltage to be measured.

13. Set the READ - CHECK CURRENT switch to the READ position.

14. Rotate the main drum dial and the small 0 - 100 millivolt dial until the meter pointer indicates zero. Main dial reads directly in 0.1 volt steps from 0 to 5.0 volts and the small dial marked 0 to 100 divisions reads directly in millivolts.

15. Read the main dial and the small instrument dial for the value of the external voltage applied. Read the main dial for the value to 0.1 volt and the small dial for the next two numbers (millivolts) to be added to the tenths read on the main dial. For example: Balance is obtained with the main dial set at 2.7 and the small dial reads 17-1/2 divisions. The external voltage is 2.7175 volts. The fourth place is the estimated half division on the small dial.

SERVICE

The only normal service required for this instrument is the occassional replacement of the batteries. The upper of the two bakelite plates on the right side of the instrument is marked REMOVE TO REPLACE BATTERIES. Remove the three screws which hold this plate in place. Replace the potentiometer battery with a Burgess XX-15 or equivelant battery. Replace the two transistor amplifier batteries with Burgess HG-502 or equivelant batteries. Replacement of the XX-15 is indicated at any time that it is impossible to bring the instrument up to the red line in the "Check Current" position. The HG-502 batteries should be replaced every third time that the XX-15 is replaced.

In replacing the HG-502 batteries it is necessary to observe the correct polarity of each battery, this polarity is marked on the metal holder for the batteries. For those applications in which mercury batteries are not tolerable, Burgess #930 or equivalent batteries may be substituted. The life of these batteries will be less than the HG-502 and replacement should be made each time the XX-15 is replaced.

A Schematic circuit diagram of the Model PC and PCM are included in this instruction sheet. However, because of the accuracy requirements at many points in this circuit, field maintenance is not recommended and the diagram is for educational purposes only.

RECALIBRATION

Occasional recalibration of the potentiometer may be required. The frequency at which this will be necessary will depend on the conditions of use, especially severe temperature cycling. In no case should this period have to be less than every 30 days. In normal operation periods of 6 months between recertifications are reasonable.

To recertify or recalibrate requires a comparison to a known accurate voltage. Unless a voltage in the range of 1 to 5 volts and known to an accuracy of ± 0.01% is available no recalibration should be attempted. The ideal recalibration voltage is 5.0 volts stable and known to 0.01%. This can be furnished by high accuracy potentiometers and voltboxes together with the necessary supplies, standard cells, galvanometers, etc. However, the total equipment accuracies must be in the order of 0.01% or such calibration is of doubtful value.

In lieu of more elaborate test facilities a single standard cell may be used as a standard of EMF to check out the potentiometer.

Preset the potentiometer as described above under Measurements, Sections 2 through 4, setting the main dial and fine dial to the known voltage and then connecting the input terminals to the known voltages. If the instrument does not show a zero deflection indicating exact agreement with the potentiometer under test adjustment is made by means of the screw on the right side of the case marked CALIBRATION ADJUSTMENT, to bring reading into exact agreement with the known standard.

CAUTION: In using a standard cell as the known voltage, it is extremely important to preset the potentiometer to the expected voltage before connecting to the cell. This is to prevent damage to the cell itself.

GENERAL CAUTION NOTES

Despite its small size this is a precision instrument and it should be treated as such. HANDLE WITH CARE. For maximum accuracy the instrument should be used in a horizontal position. Use in vertical position will slightly decrease possible accuracy although operation will still be satisfactory.

When using the instrument under widely varying temperatures use extra care in setting the zero adjustments to assure full accuracy.

Do not allow dead batteries to remain in the instrument. Discharged batteries may cause damage from corrosion effects.

ACCESSORIES

PC-S: The model PC-S Range Extension Unit is a combined shunt and voltbox for extending the range of measurement. As a shunt it provides ranges of .5 ma, 5 ma, 50 ma, 500 ma., and 1 amp. for current measurements. When used as a voltbox the ranges are 5 volts, 50 volts, and 500 volts. Shunt and voltbox ranges

have a voltage drop at rated current of 5.00 volts to give direct reading on the potentiometer dials. The PC-S range extension unit is used with the potentiometer as a single unit. It is mechanically and electrically fastened directly to the model PC by four connectors in the four corners of the instrument. When connected together the models PC or PCM and the PC-S function as a single unit.

PC-R: The Model PC-R Pocket Bridge is a wheatstone bridge which is manually balanced for DC resistance measurements. The meter of the Model PC and PCM is used as the null detector of the Model PC-R. The range of the Model PC-R is 0 to 9.999 megohms, with the following accuracies:

±1%, 0.1 ohms to 10 ohms
±0.2%, 10 ohms to 1 megohms
±2%, 1 megohms to 9.999 megohms.

The circuit of the Model PC-R is a conventional wheatstone bridge. The ratio arms are selected by the two deck multiplier switch. The standard resistance is selected by the four decade switches.

OPERATION OF PC-S

1. Place the PC-S on the right side of the model PC and connect them together by means of the four connectors in the corners of the PC-S. Early models of the PC have screw connections at the four corners. The units are joined together by four matching screws in the PC-S which are spring loaded. Place a screw-driver in the head of the connector, press in and turn to engage connector in the screw holes tapped in the potentiometer. Tighten each of the four connector screws to hold the two units firmly together. This completes all required electrical connections between the two units as well as holding them together.

2. Using the large drum dial on the PC-S, set unit to an appropriate range of current or voltage for the measurement to be made.

3. Connect voltage or current to be measured to the input terminals on the end of the PC-S unit. DO NOT CONNECT TO THE POTENTIOMETER.

4. Read the voltage measured on the PocketPot per steps 11 through 14.

5. Apply the appropriate factor to reading of potentiometer per table below to convert to correct value of current or voltage.

PC-S Range	Multiply the potentiometer reading by
.5 ma.	.1
5 ma.	1.0
50 ma.	10
500 ma.	100
1 Amp.	1
5 Volt	1
50 Volt	10
500 Volt	100

NOTES: All voltage readings made with the PC-S are at 2000 ohms per volt. They are not potentiometric readings.

The range values on the drum dial are also maximum values. Do not exceed for continuous operation. For momentary use these values can be exceeded by a factor of 3 for periods of 30 seconds, not oftener than once each five minutes. This is of importance primarily on the 1 amp range to allow occassional momentary use to 3 amperes. Do not switch ranges under load.

OPERATION OF PC-R

On the Model PC and PCM perform both the short circuit and open circuit zero adjustment according to the INITIAL OPERATIONS section. (Neither the calibration adjustment nor the current control will effect the bridge operation.) Attach the pocket Bridge to the potentiometer with the connectors provided. The connectors act as both the mechanical and electrical connections.

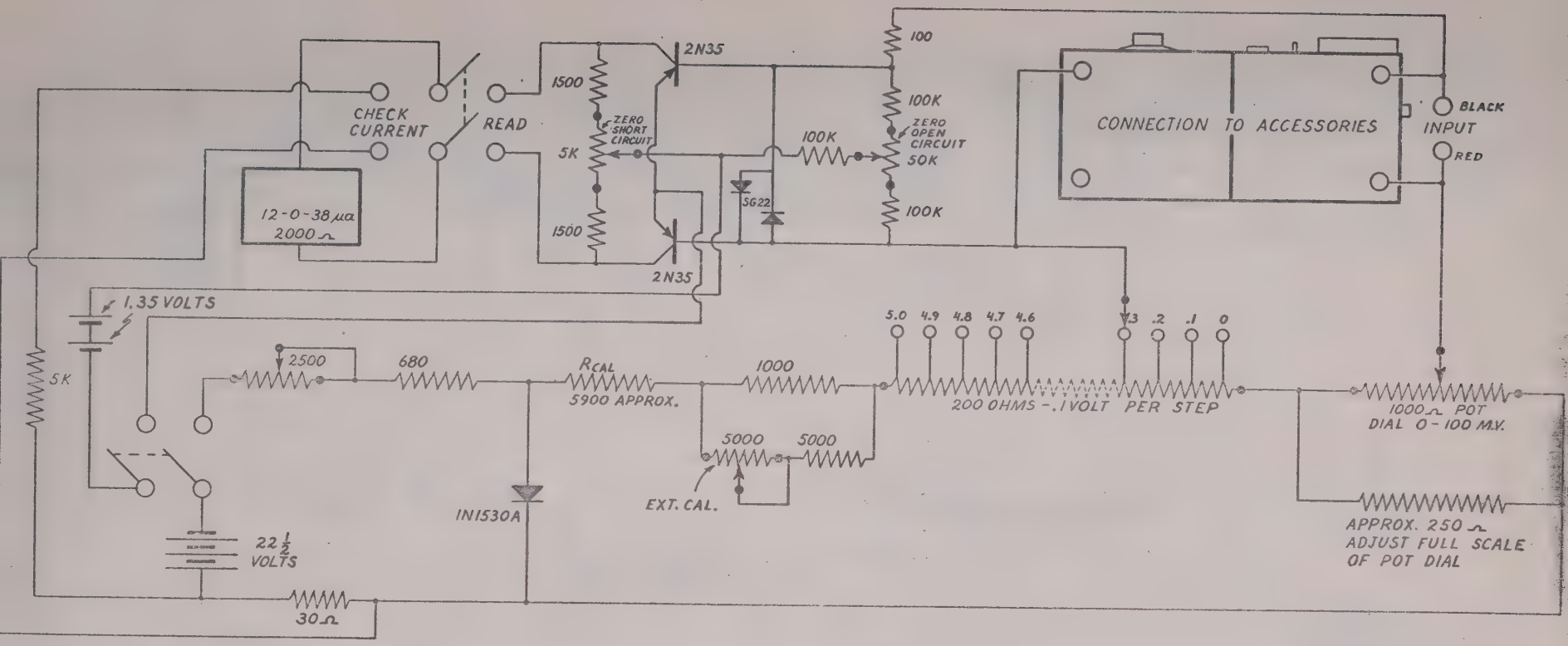
Attach the resistance to be measured to the binding posts on the Pocket Bridge. Set decades and multiplier switches to the approximate resistance value to be measured. Depress the coarse button. Adjust the switches to bring the indicator toward the null position. When reasonably close to null, depress the fine button keeping the coarse button depressed and adjust for the best null indication. The sum of the decade switches multiplied by the range switch indication will be equal to the unknown resistance.

If the direction of current through the unknown resistance is important, then the following must be observed: The red binding post is internally connected to the positive bridge battery terminal and the black binding post is connected to the negative.

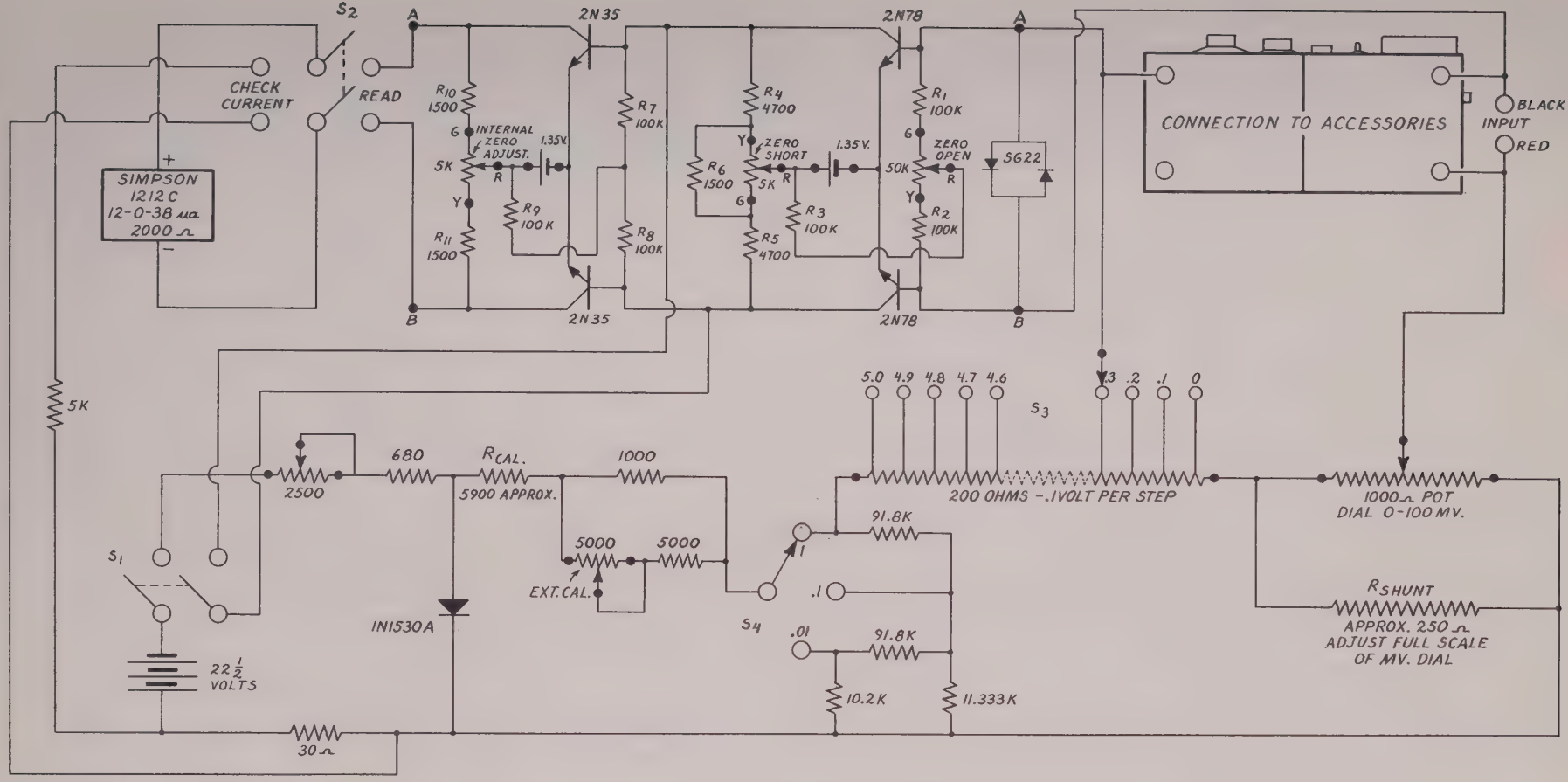
When the multiplier switch is set to the DECADE BOX position, the decade switches are connected directly across the binding posts. The model PC-R now becomes a standard resistance box with the decade switches indicating its value in ohms. In this mode of operation the Model PC-R is entirely independent of the Model PC or PCM. The current permitted through each decade is as follows:

Decade Range	Maximum Current
1000 - 10,000 ohms	20 ma
100 - 1000 ohms	50 ma
10 - 100 ohms	150 ma
1 - 10 ohms	500 ma

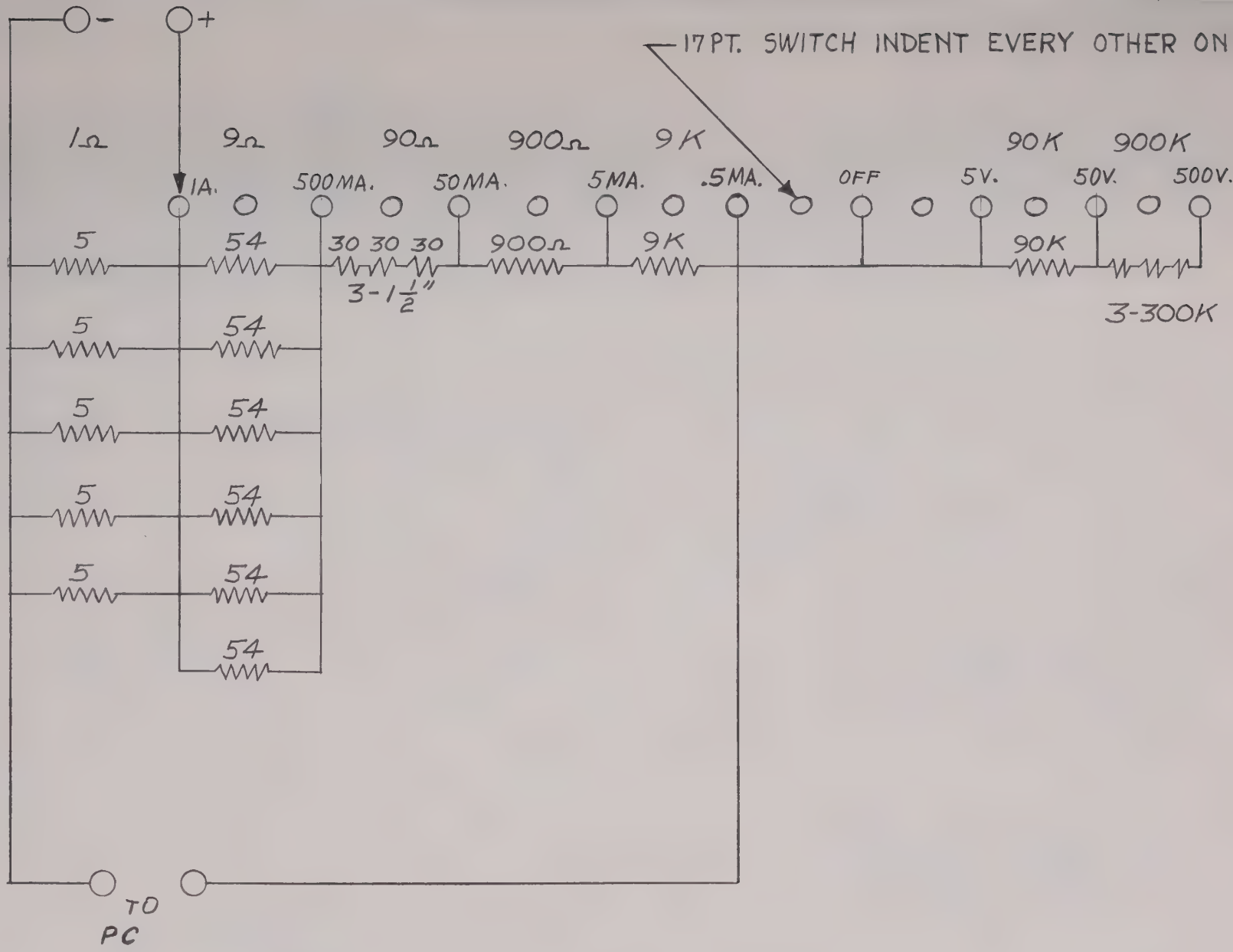
Depressing the coarse button connects the full battery voltage across the bridge circuit, this causes a large currant drain on the bridge battery when using the X0.001 range. Therefore, resistance measurements below 10 ohms should be made as rapidly as possible. Furthermore, the lead resistance in this range may be large enough to effect the accuracy of the reading. The lead resistance may be measured simply by shorting the leads. The resistance read should then be subtracted from the original reading to give the unknown resistance value.



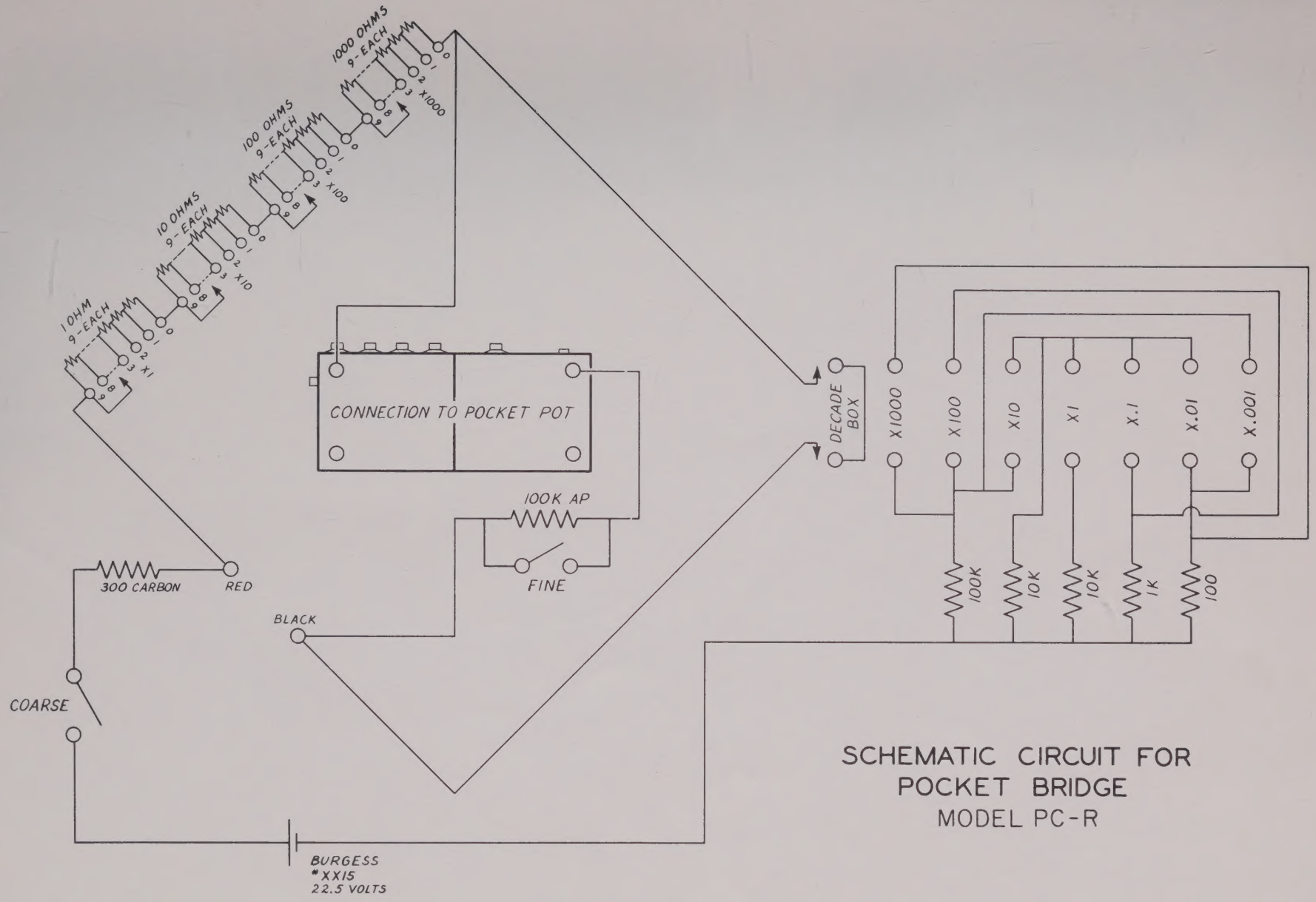
SCHEMATIC CIRCUIT FOR
POCKET POTENTIOMETER



SCHEMATIC CIRCUIT FOR
MODEL PCM



SCHEMATIC CIRCUIT FOR
MODEL PC-S



SCHEMATIC CIRCUIT FOR POCKET BRIDGE

MODEL PC-R

WARRANTY

THE SINGER COMPANY, METRICS DIVISION, warrants each new instrument to be free from defects in material and workmanship, effective after delivery to the original purchaser as follows:

*Commander** Instruments: Potentiometers, Bridges,
Volt Ratio Boxes and Standard Resistors.....5 years
*Sensitive Research** Electrical Indicating Instruments.....2 years
Other Electrical and Electronic Measuring Instruments.....1 year

Repair or replacement (at our option) without charge (F.O.B. factory) will be effected when our examination satisfactorily indicates that defects are due to workmanship or materials. Electron tubes, semiconductors, batteries, fuzes, lamps, thermoelements, and *RatioTran** potentiometers are excluded from warranty coverage. Warranty returns must first be authorized by the factory.

If the instrument or any portion thereof, has been abused, misused, damaged by accident or negligence, or if any serial number or seal has been removed or altered, the warranty is void.

This warranty is in lieu of all other obligations or liabilities expressed or implied and The Singer Company neither assumes, nor authorizes any person to assume for them, any other liability in connection with sales of instruments manufactured by The Singer Company, Metrics Division.

THE SINGER COMPANY • METRICS DIVISION
915 PEMBROKE STREET, BRIDGEPORT, CONNECTICUT • 3211 S. LA CIENEGA BLVD., LOS ANGELES, CALIFORNIA

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REPAIR AND MAINTENANCE

Instruments should be returned only on prior written authorization from the Singer Representative or the factory(1). Warranty repair will be made upon written request. Please provide the following information in order to expedite our processing of your instrument:

1. Model or Type
2. Serial Number
3. Description of trouble(2)
4. Test instruments used
5. Approximate date instrument was placed in operation
6. Approximate number of hours of use
7. Has maintenance action been previously requested?
8. Other comments

Upon receipt of this information our Service Department will send you service data or shipping instructions. Upon receipt of shipping instructions forward the instrument to the factory prepaid. If requested, an estimate of charges will be made before work begins.

(1) Contact Metrics Division, Bridgeport, Connecticut for *Commander**, *Empire**, *Panoramic**, and *Sensitive Research** instruments. Contact Metrics Division, Los Angeles, California for *Gertsch** instruments.

(2) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken, and any other relevant data.